



INL materials engineer Dawn Janney helps investigate fundamental fuel properties at INL's Materials and Fuels Complex.

INL engineer uses varied background to study complex materials such as nuclear fuel

By [Cathy Koon](#) for INL Nuclear Science & Technology communications

Dawn Janney seemed destined for a life in the great outdoors with an undergraduate degree in anthropology and a job as an archaeologist in Arizona. But her fascination with mathematics and computers led her in another direction.

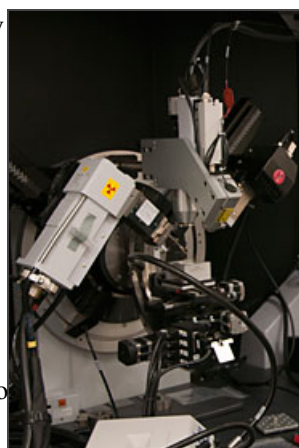
Today, she works in the desert west of Idaho Falls, Idaho, but her job at Idaho National Laboratory keeps her inside, focused on a world not visible to the naked eye — she is an INL materials engineer who started work at the site 10 years ago for Argonne National Laboratory-West and stayed on when the lab became part of INL in 2005.

"I get to look at a wide variety of complex materials, and try to understand how all of the data fits together," Janney says of her job in Fundamental Fuel Properties at INL's Materials and Fuels Complex.

"In some sense, all of my research is directed toward increasing INL's understanding of complex solid materials, either by collecting and interpreting data or by proposing and developing new techniques and approaches," Janney says. "This understanding is crucial for many aspects of the INL mission, including building world-class scientific research capabilities and developing nuclear fuels for new reactors."

She says she has three primary areas of responsibility:

- Microstructural analysis for Fuel Cycle Research and Development fuels. "This means I use a scanning electron microscope to collect pictures and chemical data from metal fuels. This data shows spatial relationships between elements and phases, which is crucial to understanding why the fuels behave as they do when heated or irradiated. I also think about how to understand microstructures better."
- Although she recently gave up day-to-day responsibility for the instrument to focus on other projects, she is a subject-matter expert for an X-ray diffractometer. "All X-ray diffractometers can provide information about phase identifications and crystal structures," she said. "The one I use is unique because it can provide information on a smaller spatial scale than most other diffractometers, and it can correlate the X-ray data with a video image. It also has the unusual capability of measuring the preferred orientation of the crystals in a sample, which may be important for understanding things like failure mechanisms in fuel cladding. This instrument will eventually be used for post-irradiation examination of a variety of highly radioactive materials."
- Principal Investigator for a Laboratory Directed Research and Development project (LDRD is a funding mechanism by which INL can provide initial funding for projects it thinks are worthwhile, rather than having to get funding from the U.S. Department of Energy or another outside entity). "The LDRD project's purpose is to develop ways for a number of analytical instruments at INL to share samples and find exactly the same area for analysis when the sample is moved between different instruments. The LDRD will also make it possible to find data from a particular area, no matter which instrument collected it."



The X-ray tube, goniometer, and detector form the heart of the X-ray diffractometer, which can provide detailed information about nuclear materials.

Janney's education and work experience are highly varied. She received her undergraduate degree in anthropology from the [University of Arizona](#) in Tucson and worked as an archaeologist for the [Arizona State Museum](#). She predicted the locations of archaeological sites based on factors such as topography, distance to water, soil types and plant communities.

"This is very important for people interested in building things like power lines, as it helps them to avoid putting towers, etc., on sites, which they then have to pay to have excavated scientifically," she says.

Next came a fascination with predictive mathematical models, and she pursued a master's degree in computer science at the [University of North Carolina at Chapel Hill](#).

"I used my computer science background as a civilian employee of the Navy in China Lake, Calif., where my tasks included writing software used in prospecting for geothermal energy and monitoring tests of blowout preventers, somewhat similar to the one whose failure caused the recent oil spill," Janney explains.

A fascination with the geothermal reservoir and a long-standing interest in geology led Janney to pursue a doctorate in geology from the [University of California, Berkeley](#), followed by two post-doctoral positions, first at the [University of Wisconsin](#) and then at [Arizona State University](#). She applied state-of-the-art electron microscopy techniques to study materials such as nanocrystals and to characterize the mineral assemblages controlling heavy-metal transport in contaminated groundwater.

Her electron microscopy skills transferred readily to materials science, leading to her position at Argonne, where she studied waste forms. She transferred to a fuels group at INL and has been there since.

Janney says she came to Idaho for the mountains and hiking, which she continues to enjoy. She also relaxes from the rigors of work by cooking, gardening (mostly vegetables), knitting and crocheting, and photography. She even does some of her own darkroom work.

Janney serves as community service chair of the [Idaho Section of the American Nuclear Society](#). Her favorite project involves coordinating donations of smoke detectors, an application of nuclear technology, to local fire departments. Her most recent excursion involved delivering smoke detectors to fire departments in the small Idaho towns of Carey and Elk Bend. She also plans to deliver detectors to Lava Hot Springs and Arimo, Idaho this weekend.

"The dedication of the volunteer firefighters and fire chiefs is truly inspiring," she says.

She is secretary of the Idaho Academy of Science, as well as an assistant editor for [Journal of the Idaho Academy of Science](#). Whether she is inside at the MFC, studying microstructures and interpreting data, or hiking the mountains of Idaho and the region, Janney puts her years of education and experience to good use, furthering the mission of INL and living the good life.

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